# THE INFLUENCE OF SOWING TERM ON YIELD AND SOME CHARACTERISTICS OF THE RYE GROWN IN A HILL AREAS

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***Abstract:*** *The rye is significant as the bread grain, of a favourably nutritive characteristics, aldough it could be used as a cattle food, for manufacturing of alchohol, starch and vinegar, cellulose, lignine, furfural and good quality paper and germs in the Pharmaceutical industry. The goal of this research work was to examine the influence of sowing term on yield in a hilly areas of North Kosovo and some indicators of the rye production which is cultivated in the organic production system. The experiment took place during 2009 and 2010 year in a hilly area of North Kosovo, at 630 m height above sea level. It has placed by system of random disposition of parcels in three repetitions. In the experiment is used the winter sort of rye, Rasha. Three sowing terms are examined. The first term was the last week of September, the second one was the middle of October and the third one was at the beginning of November. The next parameters are followed: plants height, the spike lenght, the number of grains per spike, the absolute mass of grain and grain yield with 14% of moisture, depending of sowing term. Data are statisticly worked out, by analysis of variance. Researching results are showing that the sowing term had the significant influence to all examined parameters. Plants height, the spike lenght, the number of grains per spike had significantly less value in the third sowing term, than those ones from the first and the second sowing term. The realized yield in the first sowing term could consider it self satisfactory, regarding it has been worked without usage of mineral fertilizers and chemical means for plant protection. In order to keep the rye yield on the satisfactory level, it is needed to perform sowing by the end of September becouse delaying of sowing leads to decreasing of grains yield.*

***Key words*:** rye, sowing term, number of grains in the spike, the absolute mass, the hectoliter mass, yield.

## INTRODUCTION

The rye is significant as the bread grain, especially in the north areas of former SSSR, Poland, Germany, Sweden, etc. Rye bread is tasteful, nutritious and stays fresh for a long time. It is recommended for diabetics, especially. Rye bread is an excelent cattle food also, whether for green, or in groats, flour or grains. Straw is excelent for roofs, making hats or litters. In the industry, grain is used for producing alchohol, starch and vinegar, cellulose, lignine, furfural and good quality paper and germs in the Pharmaceutical industry. The rye is very wealth with vitamins A, B and E and it has a great significance, as in nutrition of people and cattle, and in the industry, also (OELKE, 1990).

Between grains, the rye is taking the sixth place in the world by cultivated areas, before wheat, corn, rice, oats and barley (TODOROVIĆ and KOMLJENOVIĆ, 2009).

In our tract, the rye is growing less than other grains, but there is more neccessity for its growing lately. According to JEVTIĆ (1992), an average rye yield in the territory of former Yugoslavia is very low, which means that there is not enough respectful attention for seeding the rye here, as regarding the variety and farm technology, also. Research of BIBERDŽIĆ at all. (2011), emphasizes that the rye has a good competitive abilities and the lowest degree of weediness, related with another small grains.

The goal of this research work was to examine the fluence of sowing term to yield, in a hilly areas of North Kosovo and some indicators of generating rye cultivated in the organic production system.

## MATERIAL AND METHODS

The experiment took place during 2009 and 2010 year in a hilly area of North Kosovo, at 630m height above sea level. It has placed by system of random disposition of parcels in three repetitions. Preceding crops were corn and barley. The basic cultivation is performed close to rye sowing, and soil is prepared with a seedbed cultivator.For the experiment, is is used the winter sort of the rye Rasha, made in ~Center for small grains~ in Kragujevac. Three sowing terms are examined. The first term was the last week of September, the second one was the middle of October and the third one was at the beginning of November. Sowing is carried out with a sowing machine with a rate of seeding 200 kg $ha^{-1}$ of seed. Fertilizing ment usage of 10 t $ha^{-1}$ stable manure in the preliminary year. Production was carried out without usage of mineral fertilizers and chemical means for plant protection, so we could consider it as organic. Next parameters were followed: plants height, the spike lenght, the number of grains in the spike, the absolute mass of grain, hectoliter mass of grain and grain yield with 14% of moisture, depending of sowing term. Data are statisticly worked out by analysis of variance (ANOVA), statistic significance is carried out by LSD test.

### The Soil conditions

The chemical analysis of the soil is shown in the following table.

*Table 1*

The chemical characteristics of the soil

| Depth (cm) | pH in | | Humus | N | $P_2O_5$ | $K_2O$ |
|---|---|---|---|---|---|---|
| | $H_2O$ | KCl | % | % | mg/100 g | mg/100 g |
| 0-20 | 6,23 | 4,80 | 4,66 | 0,233 | 11,33 | 27,84 |

From data in the table we could see the soil is of sour reaction. It is well provided for humus and nitrogen. Fertilizing with the stable manure in a preliminary year accomplished this state of the soil. The level of phosphorus content is low, in the limits of weak to middle provision, but this soil is well provided for potassium. Although the soil is acid reaction, the exploration of NOŽINIĆ at all. (2009) tells us that the sorts of rye are very resistant to extremely acid reaction of the soil and are giving satisfactory yields in extremely dry years.

## RESULTS AND DISCUSSIONS

The rye yield and the other grains also, depends of many factors, primary of the sort, agroclimatic conditions of the area, agrotechnics, fertilizing especially etc. One of the important factors of production, especially when hill areas and higher sea level areas are included, is paying attention to optimal sowing term. According to fact that areas on a higher sea level have lower temperatures, it is needed more time for the grains maturation, optimal sowing term is very important for getting good yield.

The following table gives the review of influence of sowing terms to some parameters of cultivation of winter rye grains.

*Table 2*

Important characteristics of the rye, depending of sowing term (2009-2010)

| Sowing term | Plants height (cm) | Spike lenght (cm) | No. of grains in the spike |
|---|---|---|---|
| I (end of September) | 145 | 12.5 | 56 |
| II (middle of October) | 142 | 12.0 | 54 |
| III (beginning of November) | 136 | 10.4 | 49 |
| **Average** | **141** | **11.6** | **53** |
| Lsd 0,05 (5 %) | 3.15 | 1.55 | 4.12 |
| 0,01 (1 %) | 3.30 | 1.72 | 4.25 |

Sowing term has significant influence to plants height, spike lenght and the number of grains in the spike. An avarage height of rye plants, for all three sowing terms was 141 cm. In the first sowing term it was the highest – 145cm, and in the third sowing term was the lowest – 141 cm. Rye plants from the third sowing term had significantly lower stalk from plants of the first and the second sowing term. Height of plants is important characteristic, becouse the plants of lower stalk are more resistable to lodging. MILOVANOVIĆ at all. (2005) emphasize that this sort has an average height about 140 cm and good resistance to lodging. An average lenght of the spike was 11.6 cm. The lowest lenght of the spike had plants from the third sowing term and it was significantly lower compared with the plants from the first and the second term – there was no important difference between them in the lenght of the spike. Number of grains in the spike is very important and, besides number of plants and the absolute mass of the grain represents one of three important factors for forming the whole yield. The number of grains per spike was the highest in the first sowing term (56) and the lowest (50) had the plants from third term and those were wery significant differences. Also, plants from the second sowing term had significantly higher number of grains in the spike of plants from the third term between the first and the second sowing term there was no difference.

Table 3. shows the absolute and the hectolitre mass of the grain, as important phisical characteristics of the grain, and the grain yield which is one of the most important goals to all producers. Sowing term had significant influence to the values of the mentioned parameters.

*Table 3*

Important physical characteristics and the rye yield, in dependence of the sowing term (2009-2010)

| Sowing term | Physical characteristics of grain | | Yield (kg ha$^{-1}$) |
|---|---|---|---|
| | Absolute mass (g) | Hectolitre mass (kg) | |
| I (end of September) | 42.8 | 75.6 | 2.237 |
| II (middle of October) | 42.0 | 75.0 | 2.184 |
| III (beginning of November) | 40.5 | 72.2 | 1.650 |
| **Average** | **41.7** | **74.2** | **2.023** |
| Lsd 0,05 (5 %) | 2.00 | 3.10 | 380.30 |
| 0,01 (1 %) | 2.20 | 3.35 | 400.10 |

The absolute mass of the grain is one of the three important factors which are making influence to complete grain yield. It was from 42.8 g in the first sowing term to 40.5 g in the second term. The absolute mass of the grain achieved in the third term was significantly lower related to the first sowing term. Between the first and the second term and between the second one and the third one, there were no significant differences in the absolute mass of the grain. Hectolitre mass, which shows corpulence and fulfilment of the grain had the similar tendencies of difference between sowing terms, as the absolute mass of the grain. The grain yield is the category which is important to all the producers. It depends of above mentioned factors, as of agroecological conditions of the area, year, sort, agricultural engineering ets. Sowing term had a very significant influence to the rye yield. The highest yield of rye (2.237 kg ha$^{-1}$) was accomplished in the first sowing term, the lowest (1.650kg ha$^{-1}$) in the third one, so the difference between them was 587 kg ha$^{-1}$. Differences between the first and the second sowing term were not statisticly significant. The rye yield in the first and the second sowing term was significantly higher than yield in the third sowing term. Those results are pointing out to significance of optimal sowing term in forming of the whole yield. Plants which are seeded in the optimal sowing term have enough time to develope and to tiller before the winter, which was the case in our investigation also (the first one and, in a certain degree, the second term),

while, plants seeded off the optimal term (the third sowing term in our case) are not tillered enough or not at all until the winter frost, so that phase has to be proceeded in a spring time, which is negatively reflected to the yield. In this manner, JEVTIĆ (1992), points out that, until the beginning of the winter, at least 75% of plants of the rye have to get tillered, so he recommends sowing in the first and the second decade of September.

When is questioned the sort Rasha, MILOVANOVIĆ at all. (2005) recommend the sowing at the and of September and in the beginning of October.

Yields that are achieved in our investigations are slightly lower from the average rye yields in Serbia for 2009 year, which ammounted 2.500 kg $ha^{-1}$ (Statistic annual of Serbia 2010). The reason is absence of using of mineral firtelizers, means of protection and inappropriate agroclimate conditions.

In investigations of BIBERDŽIĆ at all. (2011) with using of mineral fertilizers and higher dosage of phosphorus, the yield of the rye reached and ammount of 2913 kg $ha^{-1}$. OLJAČA SNEŽANA at all. (2011) emphasize that the best rye yield in the organic manufacturing system is achieved with combined applying of organic biostimulators and soil improver.

## CONCLUSIONS

On basis of two-year results of rye producing in organic growing system, we could conclude the following:

- Sowing term had a significant influence to all examined parameters
- Plants height, the spike lenght and number of grains per spike had significantly less value than those from the first and the second sowing term
- Absolute and hectolitre mass of the grain weree significantly lower, compared with the first sowing term
- The grain yield in the third sowing term was significantly lower than yield from the second and the first sowing term
- The highest values of all examed paremeters are achieved in the first sowing term
- Differences in values of examed parameters between the first and the second sowing term were not statisticly significant
- The realized yield in the first sowing term could be considered as satisfactory, regarding it has been worked without usage of mineral fertilizers and chemical means of the plant protection
- In order achieve grain yields on a satisfactory level, it is needed to perform the sowing by the end of the September, becouse delay leads to decreasing of the grains yield.

## ACKNOWLEDGEMENT

The investigation published in this paper is a part of the project “The development of new technologies of small grains cultivation on acid soils using contemporary biotechnology” financed by the Ministry of Education and Science of the Republic of Serbia, grant No TR-31054.

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